Welcome to Pump Track Nation v2

By Lee McCormack

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ISBN 9781671995727

First edition published in 2006 by Lee McCormack, Lee Likes Bikes LLC, 2433 Linden Dr., Boulder CO 80304, USA.

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WARNING

Bike riding, even pump track riding, is potentially dangerous. Individual skills, tracks, conditions and equipment differ, and due to these unlimited factors beyond anyone's control, liability is expressly disclaimed. Do not attempt any techniques that are beyond your ability.

Cover photo of Lee on his backyard track by Lester Pardoe.

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What is a pump track?

A pump track is a continuous loop (or loops) that can be ridden without pedaling. Yes, you can actually gain speed — over 20 mph — by "pumping" rollers and berms.

A traditional pump track consists entirely of rollers and berms. Your pump track can also include jumps, natural features or pedaling sections. Some BMX racers even add start gates to their tracks.

This track in Eagle-Vail, CO makes good use of a small space and a steep slope:

Pump tracks range from do-it-yourself backyard loops, which are awesome (this is my first track) …

… to VeloSolutions' mega paved tracks — which are awesome too:

Know your pump track history

The first pump tracks were probably the dense BMX trails of the '70s and '80s. The modern pump track revolution traces to Australian downhillers. In 2003 a pro named Myles Mead told me about a track that slalomed downhill then looped back up — the guys were actually pumping rollers uphill. In 2005 Mick Hannah's steeply bermed backyard appeared in the movie Earthed 2, and the world saw its first pump track:

Earthed 2 — Never Enough Dirt (2005) Extras (timestamps in description box)

After seeing Hannah's yard, pro downhiller Steve Wentz built a 150-foot-long L-shaped track at The Fix Bike Shop in Boulder, CO. At first nobody could even ride the ultratight corners, but soon the local crew was sweeping off the snow and ripping on a daily basis. I posted the track on my site, Steve and I built a track at my house, and I wrote the first edition of this book. The Pump Track Nation was born in 2006.

The original The Fix track had a very tight 180. Some world champion named Brian Lopes rails it:

Emails poured in from all over the world: Thailand, Sweden, Malaysia, Australia and throughout the United States. Tracks popped up in parks, lots and yards. Ray's MTB in Cleveland, OH built an indoor two-lane pump track out of wood. This track was included in the 2006 3Ride Pro Invitational event – the first major sanctioned pump track race. BTW, Brian Lopes killed it.

Fast forward to 2019. Thousands of tracks have been built all over the world, from tiny backyard loops that cost pizza and beer, to huge paved networks that cost hundreds of thousands of dollars. Pump track racing is a part of many events, and there's even a Red Bull worldwide pump track series. Heck, there are now pro pump track racers! (I won $500 once.)

I predict that, in the way most cities have some sort of skate park, most cities will have some sort of pump track. Pump tracks are inexpensive to build (compared with other capital projects), and they serve a much wider range of users than skate parks.

Over the past 13 years I've designed and/or built dozens of tracks, and I've kept a close eye on the pump track [r]evolution. If you have the means to get a professionally built track, especially a paved one, do it. If you want to build a track yourself, especially on a budget, this book hopes to be an experienced, helpful voice.

Why build a pump track?

If you like bikes, and you have access to a small piece of land, you should build a pump track. That's all there is to it.

Pump tracks fit just about anywhere. They can be ridden by anyone. They are an extremely effective workout. They build skills like crazy. They improve other sports like skiing and motocross. They bring cool people together. They stop the erosion of the modern family. And they are really, really fun.

The Fix Bike Shop junior gravity team trains and hangs in my old back yard:

Less maintenance, water and chemistry than a lawn. Xeriscape with a purpose. Wait, let's call it exerscape.

Cheap. While some of the premiere paved tracks (e.g. VeloSolutions) cost several hundred thousand dollars, you can make your own track for the cost of drinks and food.

Inclusive. Everyone can enjoy pump tracks, from little kids and beginners to experts and pros. If you pave the surface, you also open your track to skateboards, roller skates, inline skates and scooters.

My daughters Finn and Fiona started riding pump tracks around age 2:

Close to home. 1) This means you get to ride it all the time. A few minutes here and there = awesome. 2) You can get your riding in without being away from your family. Heck, the whole family should join.

In can look nice. Flagstones in the infield … flowers on the berms … Better Homes and Pump Tracks, baby!

How much does a pump track cost?

That varies widely. Here are some general ranges.

Professionally built paved track: $100,000 to $300,000 or more.

Professionally built dirt track: $10,000-$40,000

Now for do-it-yourself tracks.

Building on top of the grade with *good* dirt: $5,000-$10,000 including equipment rental.

Digging up your yard with your buddies: Free plus hand tools, labor, beer and pizza.

This KidTopia track cost $15,000 all in, including an in-ground trampoline and the most delicious screened topsoil I've ever worked with.

Must-do checklist

If you read nothing else … read and heed this.

☐ Build your track on smooth ground with a very slight grade for drainage.

☐ Import filtered clay loam.

☐ Rollers should be about one foot tall and 10 feet apart.

☐ Berms should have radii of 10 feet.

☐ 90-degree turns should have banks of at least 45 degrees.

☐ 180-degree turns should have banks of at least 60 degrees.

☐ Before you build the track, paint it onto the ground. Check and re-check your math.

☐ Carefully place dirt on the painted track. Do it once, and do it right.

☐ Shape the dirt with shovels or rakes.

☐ Pack the dirt with feet and shovels and hand tampers then a Wacker plate or jumping jack.

☐ Water the track. Pack it again.

☐ Ride. Water. Ride. Water. Repeat.

☐ Be stoked!

Choosing a location

You don't need a lot of space. You can make a sweet track with as little as 22x30 feet of ground. You can rock hard with 50x50. Rectangles seem to work best. Odd shapes work fine. Go crazy. Be creative!

The ideal site is very slightly sloped so rain drains away. If you live in a housing development, your back yard is probably just right. Flat is OK. A steeper slope can be worked with.

My track is cut into a steep hillside:

You'll need water to build and maintain the track. Ideally you have access to a spigot and hose. Some builders simply wait for rain.

Make sure you have permission! If it's your back yard, sweet. If it's someone else's property, promise something cool in return — like all the awesome people who will hang out at the track.

Read your HOA covenants. Few will say exactly, "no pump tracks," but your neighbors can make trouble. My old neighbors hated the fact I was having fun in the neighborhood, and so they complained to our homeowners association.

I received a letter:

> "Dear Mr. McCormack,
>
> We've received numerous complaints about the condition of your back yard. You cannot rip up your lawn and build a bike track. That violates our covenants. …"

Of course, the covenants failed to say "no pump tracks." I carefully read the covenants and crafted my response:

> Let me assure you that I too am committed to maintaining the appearance and value of properties in this neighborhood.
>
> To re-quote Section 10 of the covenants:
>
> "… After a residence has been constructed on any lot, the remaining unpaved portion of the lot shall promptly be planted to [sic] grass or other vegetation or covered with decorative materials, and maintained in that condition, so as to prevent the blowing of dust and dirt from the exposed soil."
>
> I am in the process of xeriscaping my back yard to create a useful, attractive space that uses minimal water and chemicals. At this time the cold weather and frozen ground prohibit further landscaping work. When the weather warms and the ground softens, I will finish the project in accordance with the covenants.
>
> Until that time, I will make sure any exposed dirt is sufficiently packed and/or moistened to prevent blowing dust.
>
> I appreciate everyone's concern for our fine neighborhood. If you need anything, please don't hesitate to ask.
>
> Sincerely,

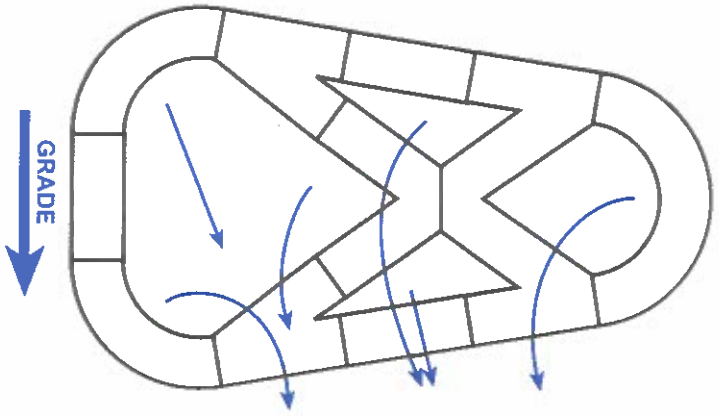
Lee McCormack

Ha! Take that.

I covered the infields with flagstone, and everything was cool.

This particular patch of flagstone has a shirtless world champion standing on it:

Grade and drainage



Goals of drainage:

- Sheet water off the site following the natural path as close as possible.
- Prevent puddles, especially on the track. Berms love to become ponds.
- Keep the riding surfaces as dry as possible.
- Allow riding soon after rain. Yee haw!

Drains. If you have an unavoidable low spot, for example at the bottom of a big 180° berm, dig a deep hole there and fill it with gravel. Send the water off your track into the hole, where it can percolate into the ground.

Pipes. You can run pipes underneath your track, most commonly under berms, but I'm not a fan. 1) Pipes fill with sediment. 2) Pipes can break. 3) This is a sign of lazy thinking. You don't need no stinking pipes. (Unless there's no other way to get water off your track.)

Look at your site. How does water drain off of it now? Ideally, after your track is built, water will drain the same way.

Route water along the flat areas inside your track, which should be at grade level. Send water outside the track through the troughs on the outside straights. These troughs should touch grade level.

To keep a berm from becoming a pond, build up the dirt on the inside bottom of the berm so water drains away from the berm. Route the water through one of the troughs on an outside straight.

If possible, orient your track across the grade. This way the berms will be less swampy, and you'll have more troughs through which to expel water.

You'll need these tools

A way to move material. A loader or "Bobcat" with a 4-foot bucket. Toro Dingo (a small loader that you stand on). Wheelbarrow. Buckets.

Toro Dingo:

If you're digging into the ground, you need a spade. Spend at least $50 on a good one.

Flat bladed shovel for moving and shaping dirt. Buy a good one. You and this shovel will become best friends. Or worst enemies.

Steel rake for filtering out rocks and for rough shaping. Try one about a foot wide; wider isn't necessarily better and, if you're filtering tons of rocks over many days, it gets heavy.

Steel hand tamper for compacting. They have 6" and 10" models. The six is easier to handle and actually packs better. Tamping a glorious 180 in Oak Creek, CO:

Vibratory plate compactor or jumping jack for compacting the track. Optional but very nice.

Push broom for sweeping (duh).

Hoe. Optional. I love using a hoe for shaping.

Water spigot and hose with adjustable spray nozzle for building and maintenance.

Big ol' tape measure. At least as long as the longest dimension on your track.

One wooden stake per turn.

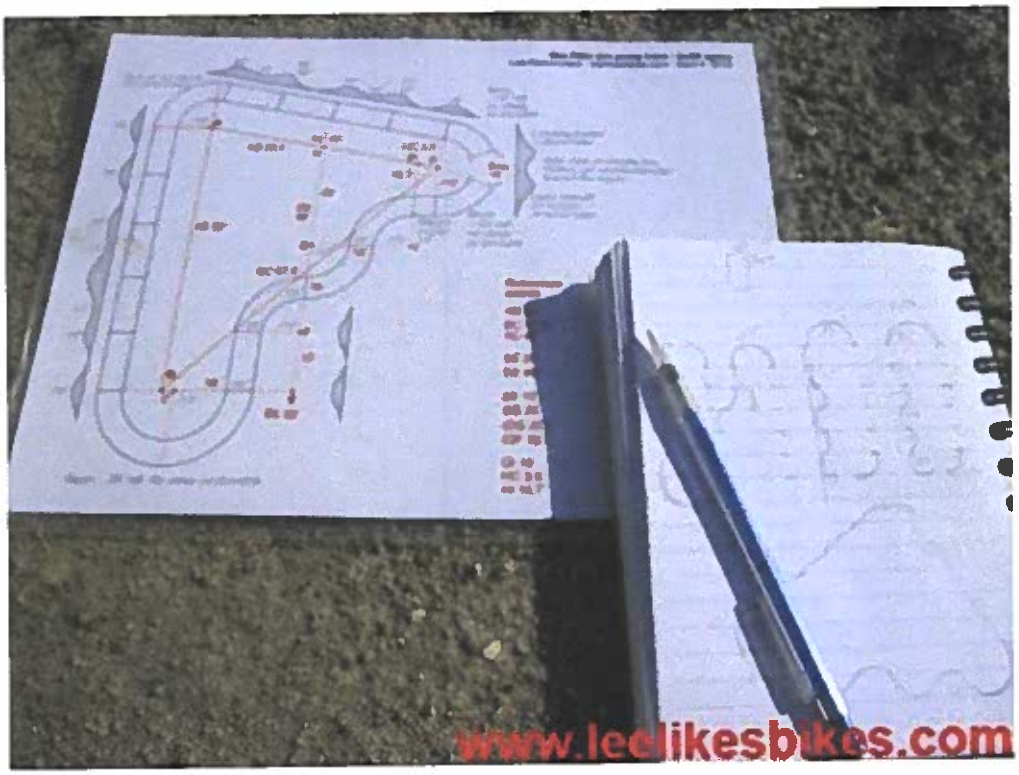
A long bit of string or twine. The stakes and strings become compasses for marking your turns.

Sharpie pen. For marking the stakes, signing autographs and occasional sniffing.

If you're hiking into the site and need one tool you can carry, check out a McLeod trail tool. It's a combo shovel, hoe, rake and tamper — one of the main tools that trailbuilders use. BTW: If you mount a McLeod onto your Tacoma, people will know you're the real deal.

Often known as a McLeod fire tool.

A build sheet with your design and reference points. I showed up ready for Sea Otter 2010, but the site changed, so I had to make a new design on pencil and paper:



Food and drink. Pump track work days are long and taxing. Take care of yourself and your volunteers.

Patience. This is a major project! No matter what, building a track is a very physical endeavor. By the time you build the track, you'll be strong enough to ride it.

A bike! To blue-groove the track.

Don't make these mistakes

I've seen a lot of pump tracks, and I need to say two things about them:

1) All pump tracks are fantastic simply because they exist. The work it takes to plan, get permission and build, that's serious, and I offer kudos to the people who make it happen.

2) That said, the majority of pump tracks aren't as good as they can be. Some of them truly suck, and that's a major bummer.

The mistakes made are common and repeated. Please, please, please: read and heed this list.

Lack of help. Building a pump track on a budget is a lot of physical work, and you'll need bodies. Once I spent a very hot humid weekend building a track in Michigan, and the only people who showed up to work were dudes from the jail. They were helpful, but you'll be happier working with a bunch of stoked rider/volunteers.

Lack of maintenance. Over the years I've heard a lot of people promise to maintain their local pump track, but I've seen (statistically speaking) about zero of them follow through. This issue is compounded when the original build is crappy; it demands extra maintenance, but no one is stoked to maintain it because it sucks, and it turns to dust and weeds. The most successful maintenance is performed by government entitities and very hardcore riding clubs.

Excessive complexity. It's fun to dream about huge tracks with lots of loops and subloops, but most people are very happy riding the main outside loop, which gets hardpacked and fast. The unused interior lines get loose and unrideable. I strongly suggest making your track simple. All suggestions in this book are based on simple tracks because I know that's your best chance at success.

I designed the pump track at Lory State Park in Fort Collins, CO to be big and advanced and sick. It was indeed advanced and sick, but it was too big and complex for most people, and the inner techy lines like this one rotted and became unrideable:

(If you're paving your track, maintenance is a non issue. Go nuts.)

Not designing for riders. The volunteer crew might be a bunch of local BMX pros, and we know they love big/advanced tracks, but who's going to be riding this track? Kids? Beginners? Families? Design accordingly.

Not compacted enough. Compacting the dirt on your track is real work. If you don't compact it enough before you ride, you end up with ruts, bumps and a slow surface. A vibratory plate compactor (aka a Wacker plate) or a jumping jack makes this a lot easier.

Ridiculous rollers. There are lots of ways to screw up rollers: too tall, too pointy, too close together, too far apart. If your track has any flat ground on it, that's a fail.

Bad berms. Not steep enough. Radii too tight. Multiple radii in one turn. Lack of roller at the beginning and end of each berm.

Poor material. The dirt is too sandy or rocky or silty or filled with roots. Once I showed up to a build, and the material was compost — it simply wouldn't pack together, plus it was full of plastic wrappers. The guy at the local materials yard knew we were in a bind, and he charged us premium for topsoil.

Hiring the wrong people. Spending money does not ensure a lack of suckage. Some of the most tragic tracks I've seen were built by "professionals." Before you hire, make sure they know what they're doing. Ride their tracks with a critical eye. Find out whether their tracks needed tweaks after the initial build; that's a no-no.

This track checks most of the boxes:

- The dirt is too sandy. It's coming apart where the surface treatment has worn away.
- Excessively large and complicated. The inner lines are barely rideable.
- The original build wasn't dialed.
- It isn't being adequately maintained.

Dig down or stack up?

Should you dig down into the ground, using the endemic dirt, or should you bring in dirt from offsite and build on top of the ground?

If you're building on flat ground, it's best to bring dirt in and build on top of the ground. This maintains the current grade. If you need to dig down and use the in-place dirt, be mindful of drainage (you'll likely need drains in your low spots).

> Because most people build on flat ground, and it's way better to bring in dirt, for the most part this book assumes you're bringing in dirt.

Here's my original track before ...

... and after. We dug drains in the low spots.

If you're building on a hillside, you can dig down while maintaining easy drainage (it's like building a singletrack trail in the mountains). If you want to import even more dirt, have at it!

My current track is hand-dug into the hillside. It drains itself and needs little work:

Do you want a track or a park?

When you're thinking about the design of your track, the first philosophical question is:

Do you want your pump creation to have established path(s) with clear directions, like a BMX track, or do you want to lay it out so there are lots of possible paths in all directions, like a skate park? Of course, you can build a combo of the two.

This decision has an effect on the utility, safety and appeal of the track, so let's dig in.

Established paths, like a track

Back yard of AA Pro BMX racer Jason Richardson:

Pros:

- Less to build and maintain. The main lines stay ridden in.
- Lower probability of collisions.
- If they're going the same way, many riders can be on the track at once.

- Open area for staging, lawn, deck, etc.

Cons:

- Fewer riding possibilities.
- Less engaging for advanced riders.

Many lines, like a skate park

VeloSolutions pump park in Sils, Switzerland:

Pros:

- Expands the riding possibilities.
- More fun rad $hit to do. Keeps advanced riders more engaged.

Cons:

- Harder to maintain (unless it's paved).
- Higher probability of collisions.
- Harder to have multiple people on the track at once.

Skate parks have tons of line options, and they are considered safe enough, but skate parks have a strong culture of etiquette (follow it or get your ass kicked), which is enforced by experienced skaters and followed by the small number of users.

Pump tracks have much more varied users, and they don't have the same self governance as skate parks (and we don't want to replicate the skatepark culture). From a safety standpoint, it makes sense to assume people don't know the rules and are not paying attention. This, plus the maintenance issue, is why I generally design tracks rather than parks.

Imagine yourself at a deposition for someone who got hurt on your track by a rider who came in from an alternate line. Imagine explaining why you laid out the track the way you did — why you added an alternate line that could result in a collision. You don't want to be in this situation. If you are, you want to be able to say you took every precaution to ensure a safe track.

That's my safety speech.

Pump parks seem best when 1) they are paved and 2) there is a well informed ridership. Pump tracks seem best when 1) they're made of dirt and 2) you're taking all of the safety precautions.

A clever way to multiply riding options while minimizing the downsides of a park is to design a track with clear paths, but whose paths cross near each other. There won't be a "Hey Dude, jump from here to there" sign, but the possibilities will exist for advanced riders. Advanced riders, the logic goes, know the rules and are paying attention, so this is a safer way to multiply the riding options.

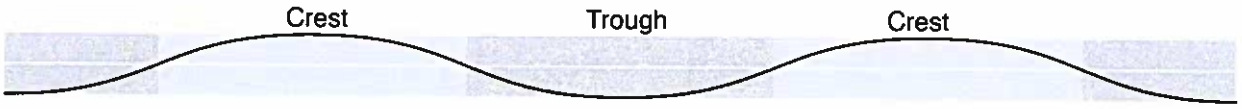
The Pacific Highlands Ranch Pump Track in San Diego is, I think, very clever. It has established routes with directional arrows, plus some interesting line options:

Here's another good one. The clear paths cross near each other so advanced riders can explore transfer lines.

How pumping works

To make your track ride great, it helps to understand how pumping works. Put simply:

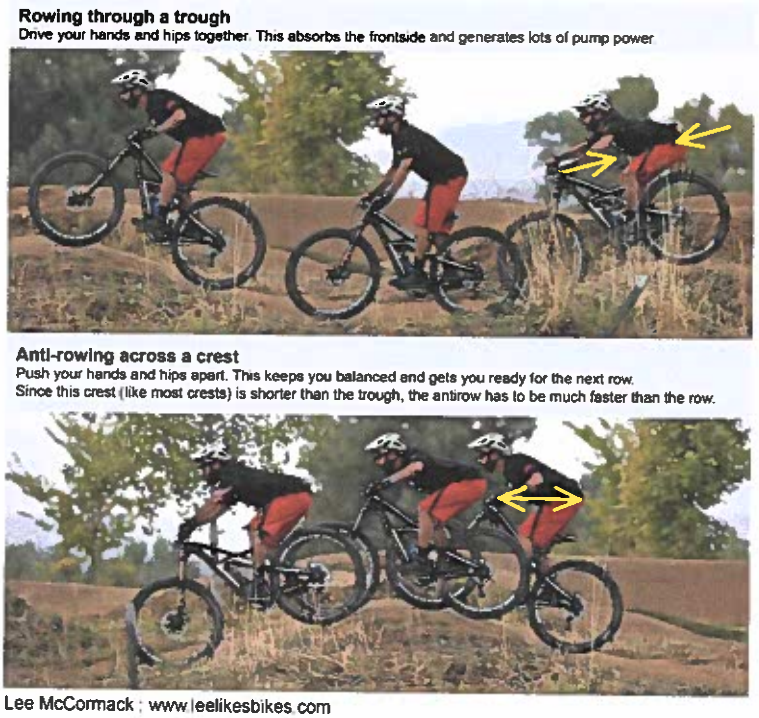
A good set of rollers is a sine wave. The wave has troughs and crests. If you draw a horizontal through your rollers at the midpoint of the rollers' heights, everything above the line is a crest. Everything below the line is a trough.



Row through troughs. As your bike passes through a trough, pull your hands back while you push your feet down. This levers the bike through the trough and generates pumping power.

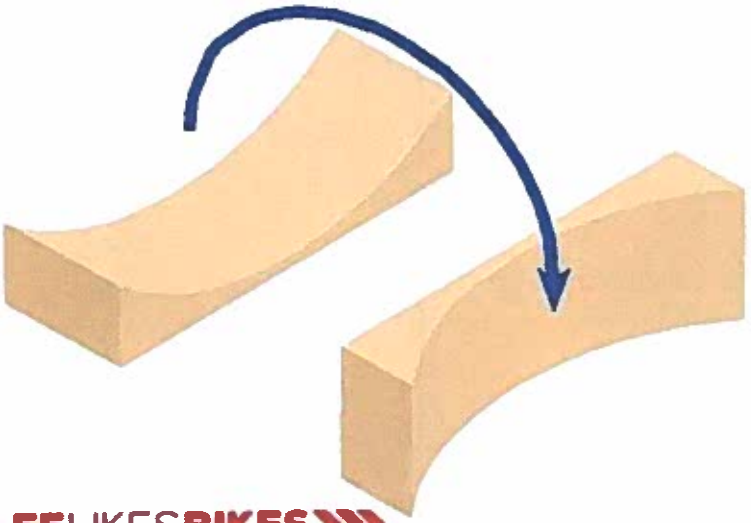
> I used to believe pumping power came from pushing down backsides. That works, but this row/anti-row thing works better.

Anti-row across crests. As the bike passes across the top of the wave, push your hands forward while you pull your feet up. This levers the bike across the crest and resets your bike and body for the next row.


Rowing through a trough
Drive your hands and hips together. This absorbs the frontside and generates lots of pump power
Anti-rowing across a crest
Push your hands and hips apart. This keeps you balanced and gets you ready for the next row.
Since this crest (like most crests) is shorter than the trough, the antirow has to be much faster than the row.
Lee McCormack : www.leelikesbikes.com

When you pump rollers, row and anti-row in a nice, round, smooth cycle. The better your rollers are built, the easier this is.

When you pump a corner, you should do the same thing, except sideways. Yes: A corner is a sideways hole!



LEELIKESBIKES

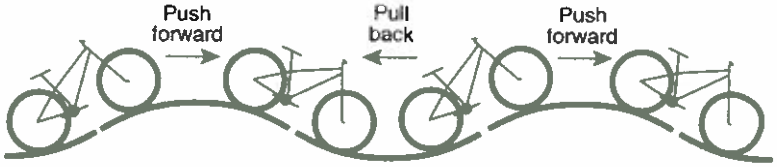
Pumping a sideways hole at Valmont Bike Park. Photo by Leslie Kehmeier.

Those are the basics. Now for …

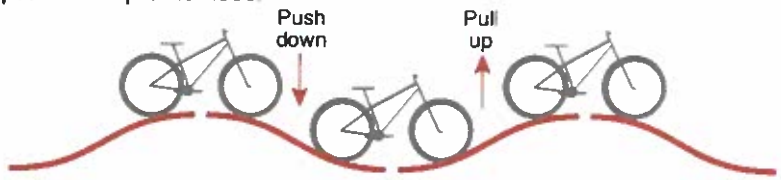
Turbo next level pumping technique

When you watch pro pump track races, you'll see some very round movements.

Using your arms, push your bars forward across crests and pull them backward through troughs.



Using your legs, push your pedals down into holes and pull them up onto rises.



The timing of your upper and lower bodies is offset.

Your hands and feet move in an elliptical path. Pretty cool!

Lee McCormack : leelikesbikes.com : llbmtb.com : riprow.com

To learn more about pumping (with videos), check out www.leelikesbikes.com.

Rad rollers

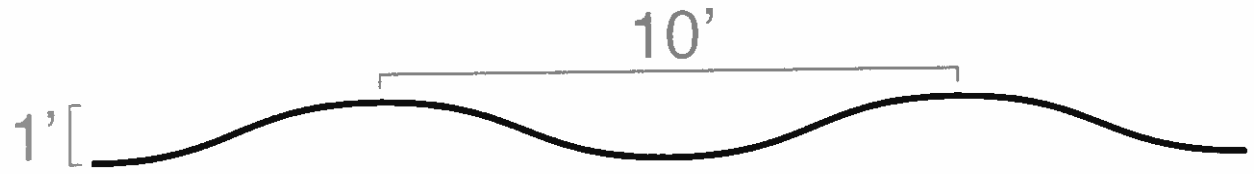
Show me some great rollers, and I'll show you a great time. Some tips to make your rollers really roll:

Sine wave of love. Make your rollers as smooth and round as you can, like a sine wave. We don't want holes, ruts, bumps or any sudden changes in direction. I'm going to say this again: Make your rollers as smooth and wavelike as you can. Smooth! Wavelike!

No flat spots! Every flat spot on your pump track is a dead spot. You lose engagement, pump and fun. No. Flat. Spots. Anywhere on your track.

1:10 is a great roller:straight ratio. Rollers that are one foot tall and 10 feet apart work very well. If you're going fast, so do rollers that are 15 inches tall and 12.5 feet apart, or 18 inches tall and 15 feet apart. If you're going really fast, two feet tall and 20 feet apart is fun too. You can go tighter or wider with your ratios, but beware:

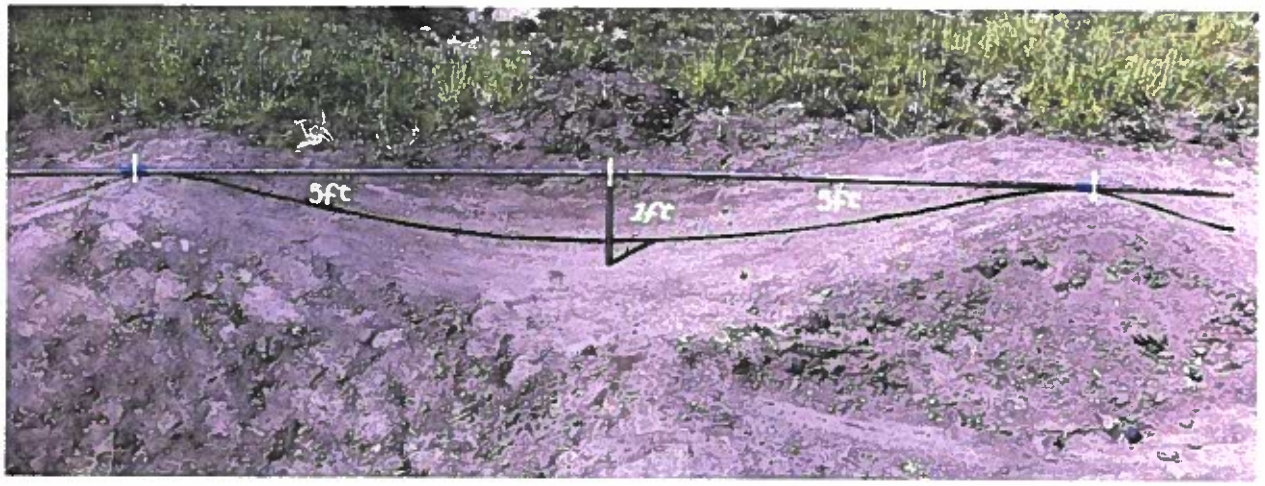
- Too tight and it's hard to maintain speed. This is one of the main mistakes you see in pump tracks.
- Too wide and it's hard to generate speed. That's one of the other main mistakes you see, especially if you throw a flat spot in there.



Put simply:

- Close-together rollers make it easy to generate speed, but hard to maintain speed.
- Far-apart rollers make it hard to generate speed, but easy to maintain speed.
- 10- to 12-foot spacing seems to be a good compromise for most situations.

www.trailism.com made a cool tool to check roller-straight ratios:



In a perfect wave, the troughs and crests have the same shape and length. This makes the track feel very smooth, and it's easy to carry speed. Why? The row and anti-row each take equal time.

Rollers are often too pointy. You end up with long troughs and very short crests. This makes the track feel herky jerky, and it's hard to carry speed. Why: The anti-row has to be way faster than the row, and most riders simply can't move fast enough.

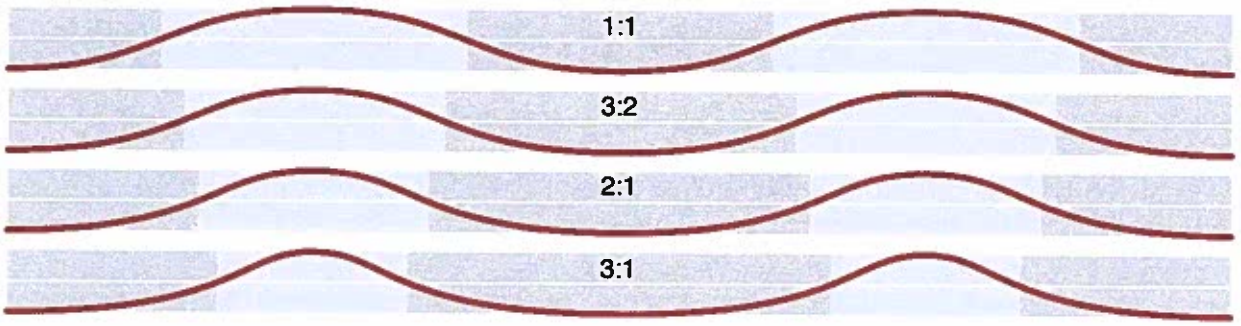
You do not want pointy rollers! Unless:

You're building an expert track. The downside of pointy rollers is the short crest and fast anti-row. The upside is the long trough and long row. If you have the skill and power to anti-row fast enough, you can generate extra pump during that long row. In the right hands, this makes the track faster, and the steeper rollers make better jumps.

AA Pro BMX racer Jason Richardson's track was built to mimic the peaky indoor tracks he raced in Europe. Most mortals would find this track very hard to ride:

Trough:crest ratios

Because pumping is all about row/anti-row, and row/anti-row timing is tied directly to the relative lengths of troughs and crests, your rollers' trough:crest ratio has a huge effect on how your track rides.



A ratio of 1:1 makes a perfect sine wave. This gives you perfectly even row/anti-row and a very smooth, soothing ride. Prefabbed rollers are often perfect 1:1 waves, and they are super fun:

A ratio of 3:2 gives you a smooth, fast track with a bit of extra space for rowing power. These 3:2 rollers are small but super fast:

A ratio of 2:1 or higher starts to feel pointy. This is best for expert riders and for when you want the rollers to be more jumpy. This roller is close to 2:1, and it's very disruptive at speed:

A ratio of 3:1 starts to feel like a jump. There's nothing wrong with jumps, but don't build your rollers this pointy unless you're doing it on purpose.

Trough:roller ratio (roller spacing is 10')	Length of trough	Length of crest
1:1 "perfect"	5'	5'
3:2 super sweet	6'	4'
2:1 pointy	6'8"	3'4"
3:1 jumpy	7'6"	2'6"

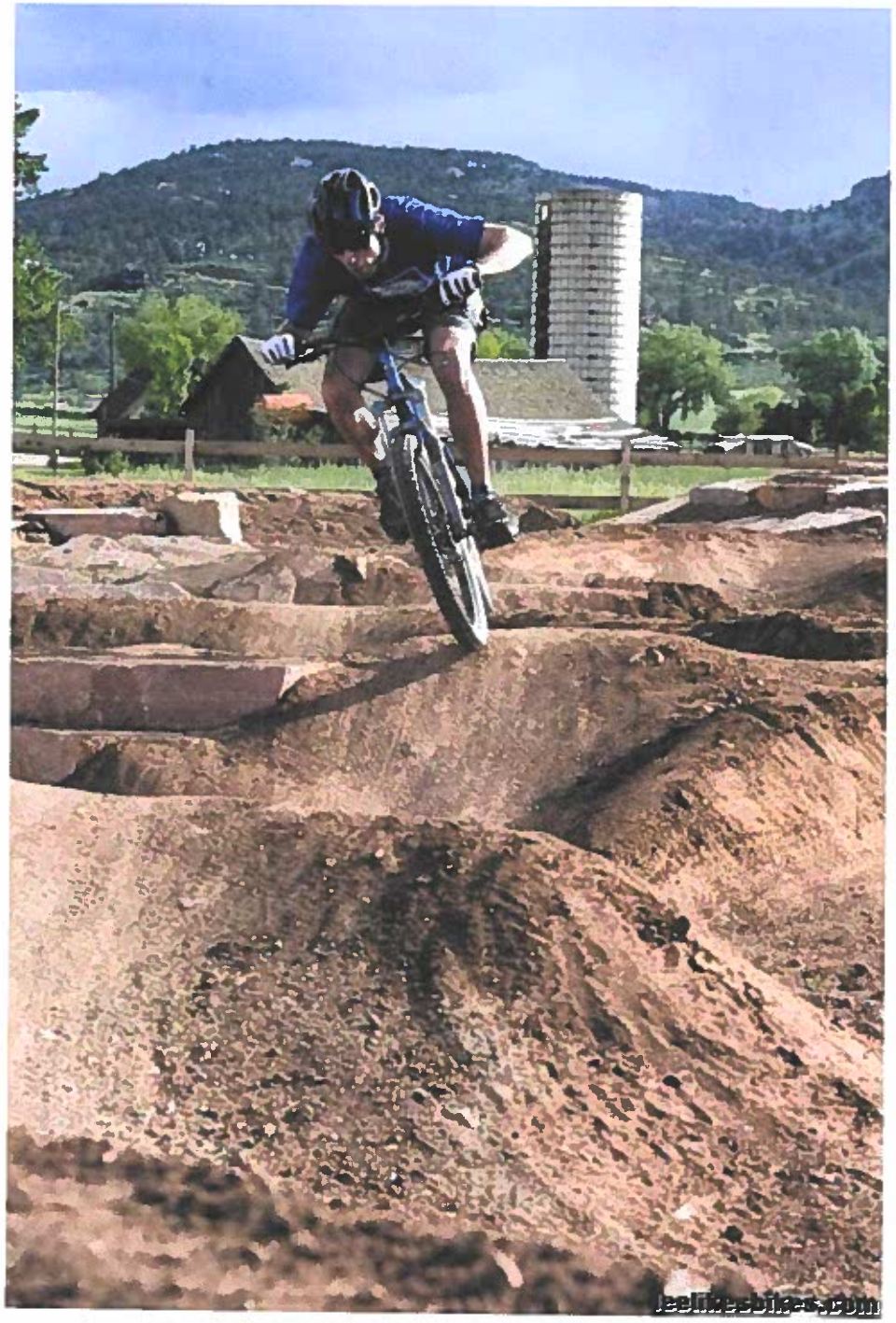
When designing rollers into your track, keep in mind there will be

- The width of the track, which is usually the width of a skid steer loader's blade, which is about four feet.

- The sides of the rollers, which are about as wide as they are tall.

So a straight with 1-foot rollers would be 6 feet wide. Plan accordingly.

Rock some rocks. If you're so inclined, you can mix rocks, logs and other natural features into your track. Lyons Bike Park in Lyons, CO:



Your straights don't have to be straight. Feel free to make slight turns using rollers. This is a flexible, easy alternative to building berms. My back yard track has some wedge-shaped rollers for carrying speed and changing direction:

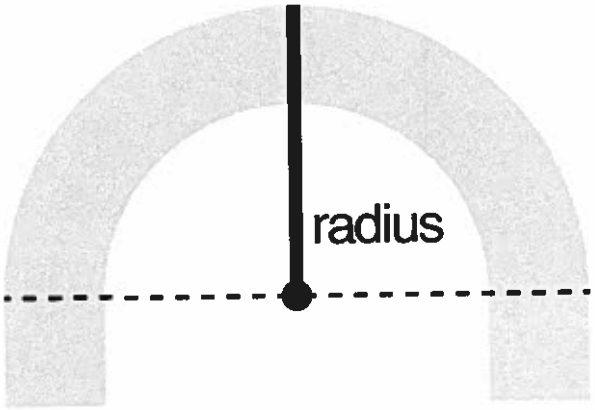
It's really difficult to build round, wavelike rollers. That's probably why so few tracks (even professionally built ones) have them. I implore you to really try. The rounder and more wavelike your rollers, the better your track will ride.

Beautiful berms

Pumping is fun. Cornering is fun. Pumping a corner is even more fun. Some tips for shreddable berms:

It all starts with radius. A berm's radius is the distance from its centerpoint to the outside of its riding line, as viewed from above. 10-12 feet is a good all-around radius for pump track corners.

- You can go tighter if the riders are advanced and the berms are very steep.
- You can go wider if the track is very fast.



The radius should be constant. That is, the curvature of the turn should remain the same from the entrance through the exit. No holes. No bumps. No low spots. No high spots. Just a constant curve.

When you corner, the radius of the turn and the square of your speed determine how many G forces you pull. A mellow turn might be 0.5G. A great rider can pull 1-2Gs. A pro can pull 3Gs. For every amount of Gs, there's one lean angle that balances the forces of gravity and cornering. Ideally, your berm's banking matches or exceeds that angle.

For a turn radius of 10 feet:

Speed mph	Gs	Lean angle
10	0.7	34°
12.5	1.0	45°
15	1.5	56°
20	2.7	69°

The faster the rider is going, the greater the Gs, the greater the lean angle and the taller/steeper the berm should be.

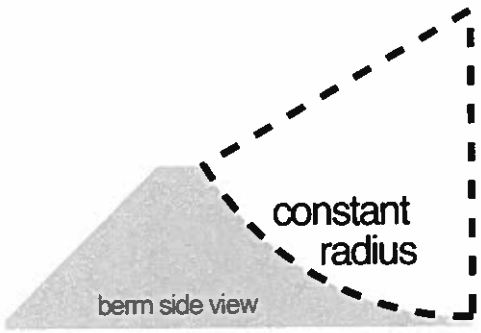
180° berms provide a major change of direction. They should be at least three feet tall and have banking of at least 60° (70° would be better). I'm going to put this right here: Make your 180-degree berms as tall and as steep as you can. Tall. Steep.

Four feet tall and almost vertical. Check and check:

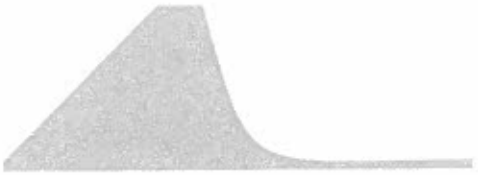
90° berms are less about changing direction and more about pumping into and out of a sideways hole. 90s can be as low as 18-24 inches tall and have banking as low as 45 degrees.

Side to side to side to side … such a sweet track:

As viewed in cross section, your berm's bank should have a constant radius that goes from level ground at the inside of the track to its steepest point at the top of the berm. This provides lots of line options and an easy progression from slow/low to fast/high.



Not like this. The steep banking is good for fast riders, but there isn't much space/transition for ordinary people. The berms at the Sea Otter Classic dual slalom are like this. Great for pros, not great for schmoes.



Not like this either. This berm has only one (mellow) slope angle. It'll only work at low speed. Riders who go faster will tear up the surface. This mistake is all too common.

The steeper your berm is, the taller it needs to be. This is because 1) to make dirt steep, you must stack it high and 2) a taller berm makes it easier for riders to stay on their optimal lines, because the lines are wider.

Imagine rolling a marble around inside a round bowl. It finds its natural rolling line. Bikes in berms are like that. For one Sea Otter pro pump track, we made the 180-degree berms almost head high with 70-degree banks.

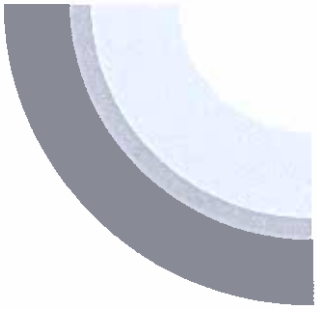
The main 180 berm at the Superior Bike Park pump track had a 60-degree bank:

You cannot make a berm too tall or too steep. It's a bit like being too rich or too good looking.

When designing berms into your track, keep in mind that there will be

- The width of the track itself, which is usually about four feet.
- The width of the top of the berm, which is usually about one foot.
- The width of the back of the berm, which is usually as wide as it is tall.

A 3-foot-tall berm would be eight feet thick from the inside of its riding surface to the outside of its back. That's really thick! Plan accordingly.



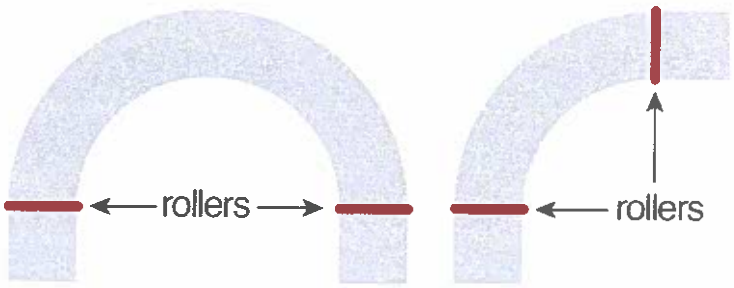
You can reduce your berm's footprint by building a retaining wall on the back. This lets you fit bigger turns in small spaces (like perhaps your side yard). Filtered fill with sandstone wall in Lyons, CO:

Learn more about retaining walls by Googling "how to build a retaining wall."

About track layout: Most riders slow down and have to pedal in 180-degree berms. I like to use 90-degree turns throughout the track to build easy speed. At the end of the fastest straight, that's where I put the 180. It's so fun to rail!

Berm-rollers

At the beginning and end of each berm, there should be a roller. The roller should be built perpendicular to the riding line, at the precise spot where the end of the straight meets the beginning of the turn. This is essential for a great-riding track.



One hallmark of crappy pump tracks is a lack of berm-rollers. This creates pumping dead spots in the turns. You tend to lose speed entering the turn, and it's hard to accelerate while exiting the turn. These are nice turns, but speed doesn't carry easily from berm to berm because the rollers are missing:

Good berm-rollers makes the straights flow smoothly through the turns. When you're entering the turn, the backside of the entrance roller becomes the "downside" of the

berm; you can pump this surface to gain or maintain speed. When you're exiting, you can pump the backside of the exit roller to gain even more speed.

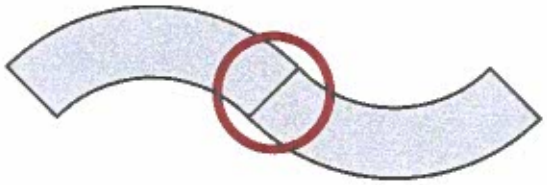
The rollers and berm should flow into each other, like an extension of the rhythm you created on the straightway.

It looks cool (and rides well) when the outside of the berm-roller matches the height of the berm, and the inside tapers to grade level:

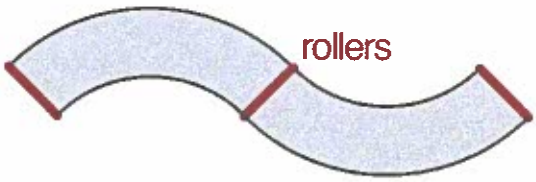
Berm-to-berm transitions

Pumping from turn to turn is one of the coolest feelings in pump tracking, and in mountain biking. All the sweetest tracks have berm-to-berm transitions.

Butt your berms up against each other. The beginning of one berm should occupy the same exact space as the end of the other.



Place berm-rollers where the berms meet (and at the beginnings and ends of all berms).



Build the transition roller from the top of the end of one berm to the top of the beginning of the next berm. If you want to angle the roller a bit like this one, feel free.

Some berm-to-berm action at the 2010 Sea Otter Classic pro pump track:

Building interchanges

Crossover lines add options and fun galore, and they let you turn in more than one direction. This ain't Nascar!

Interchanges from outside berms to crossovers

1. Finish the berms on the ends of the straights.

2. Mark the inside berm. Mark the rollers for the entire straight. Your interchange berms will be next to rollers. You will build these berms and rollers together.

3. Begin to pile and shape the interchange berm and roller.

The interchange berm and roller should flow smoothly from the outside berm. The front of the roller is part of the outside berm, which is part of the transition berm, which is the front of the roller ... It's a complex 3D shape!

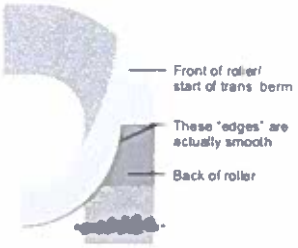
4. Do the final shaping, packing and watering. Finish the other roller on the straight. Water, wait a day then ride!

5. Finish the other rollers on the straight.

2.

3.

4.



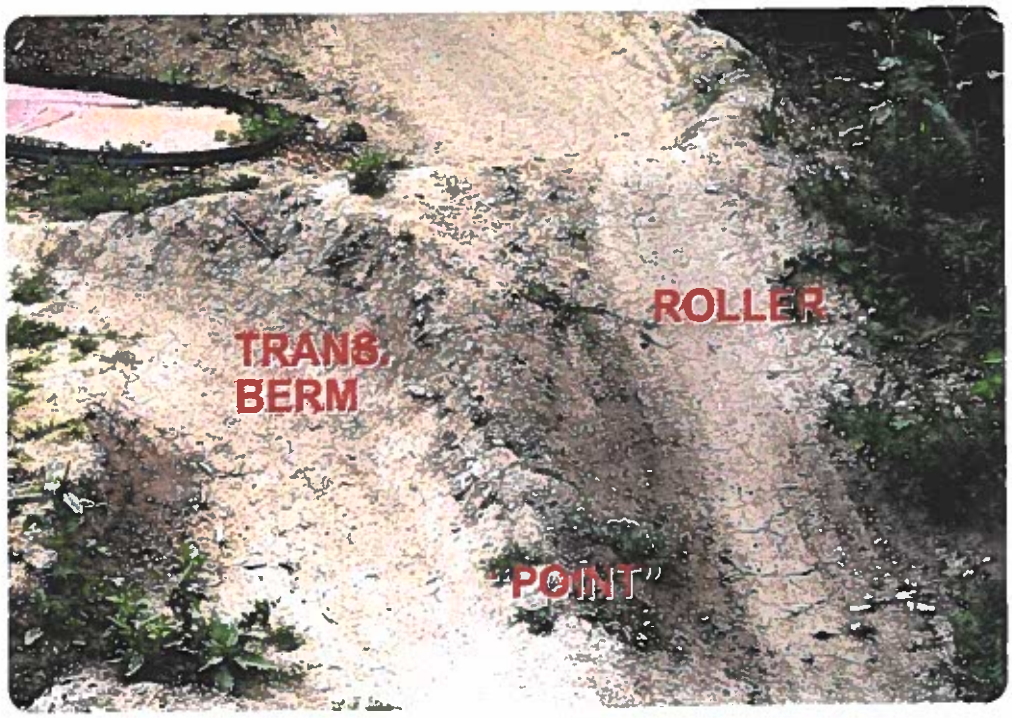
Interchanges from side straights to crossovers

1. Finish the outside berms on the ends of the straights, as well as any interchanges from the outside berms.

2. Mark the inside berm. Your rollers should already be marked. Your interchange berms will be near rollers. You will build these berms and rollers together.

3. Begin to pile and shape the interchange berm and roller. The berm will "point" into the straight, like a freeway off-ramp.

4. Do the final shaping, packing and watering.



Sweet jumps

If rollers and berms are a pump track's bread and butter, jumps are the jam. With creative track design, riders can enjoy endless combinations of pumping, manualing and jumping. Here's a fun option in my back yard:

Any two (or three or four) rollers can be jumped, if you have enough speed and pop. To encourage jumping, you can space some rollers closer together. Give them a tighter roller:straight ratio, say 1:5-1:8 instead of the standard 1:10.

Tabletops are what they sound like. There's a lip and a landing, with a flat table in the middle.

Tables give beginning jumpers lots of confidence to go for it, but the flat tops aren't pumpable, so they disrupt flow. For most riders a better choice is ...

Roller-doubles are the blessed offspring of a pair of rollers and a tabletop jump. They are both pumpable and jumpable, and they're also quite manual-able. If you want jump options on your track, roller-doubles are the way to go.

The better you shape a lip for jumping, the harder it's gonna be to pump, and vice versa. For most people and most tracks, I suggest finding a middle ground.

Too pumpy (unless you only want to pump)

Too jumpy (unless you only you want to jump)

Ah, just right (good for pumping, manualing and jumping). Many BMX track roller-doubles are shaped like this.

The more skilled and powerful your riders are, the taller and peakier your track's features can be. The less skilled and powerful your riders are, the smaller and smoother your track's features should be. For a good all-around roller-double, try about 24 inches tall.

A transfer is a jump from one line to another, often across a gap. You can lay out your track to encourage transfers. Whenever a great rider comes over, she's gonna show you lines you've never thought of. That's still happening on my track, and it's 10 years old.

The Man Himself, Mark Weir, boosts a big transfer in his back yard:

Designing your track

Designing your track can be the funnest part of the project (aside from riding, of course). Here are some thoughts to guide your process.

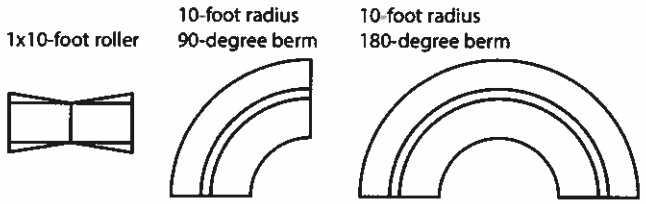
Use a tool you know. People design tracks with CAD programs, vector graphics programs (I use Illustrator), free online drawing programs, graph paper and even with clay models. Use whichever tool gives you the most confidence. This way your brainpower goes into designing your track, not learning a new tool.

Orient your track across the grade. This makes the berms less likely to become puddles, and it gives you more troughs through which water can leave the track.

If you're building on a hillside, *really* orient the track across the grade so you gain speed on the straights and gain and lose elevation in the turns. Be extra stoked because you can dig into the hillside and maintain easy drainage. My track:

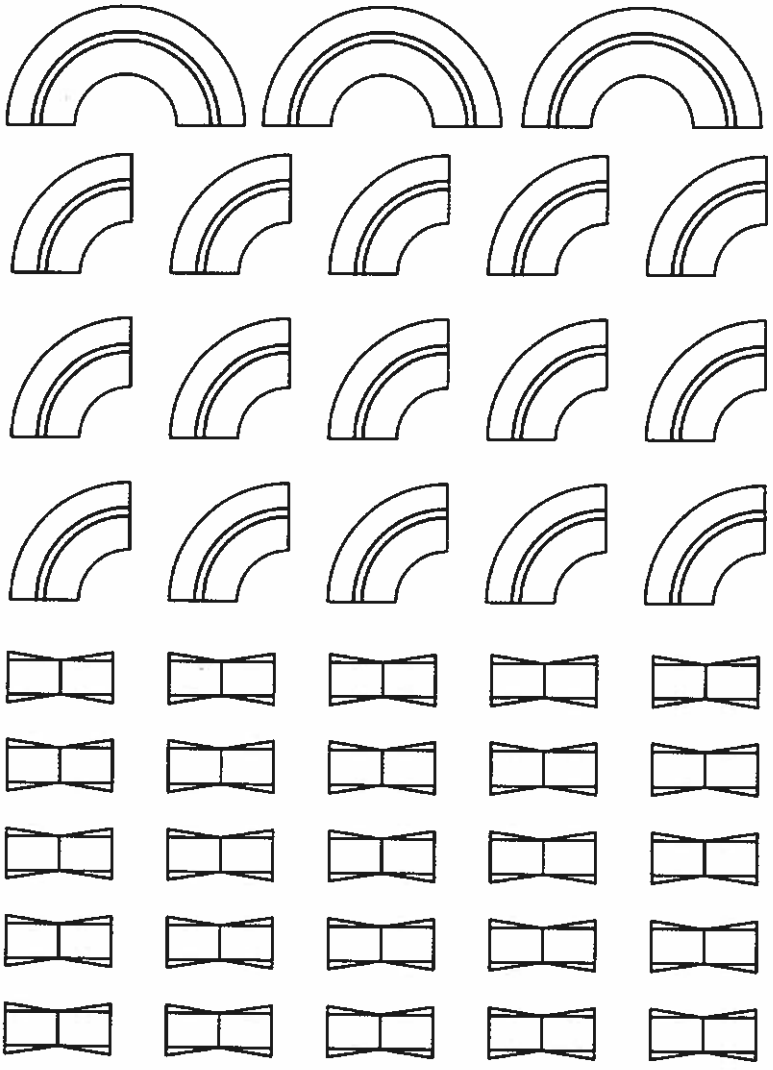
If you're building on natural terrain (ups/downs, rocks, trees), incorporate the terrain into your track. Heck, incorporate your back yard's layout into your track. 180 around the BBQ, jump over the hot tub ...

Work with the Legos. For me, the building blocks of a pump track are 10-foot-long rollers and 10-foot-radius corners (90° and 180°). I copy/paste these in a graphics program and mix/match them until I get a layout I love.

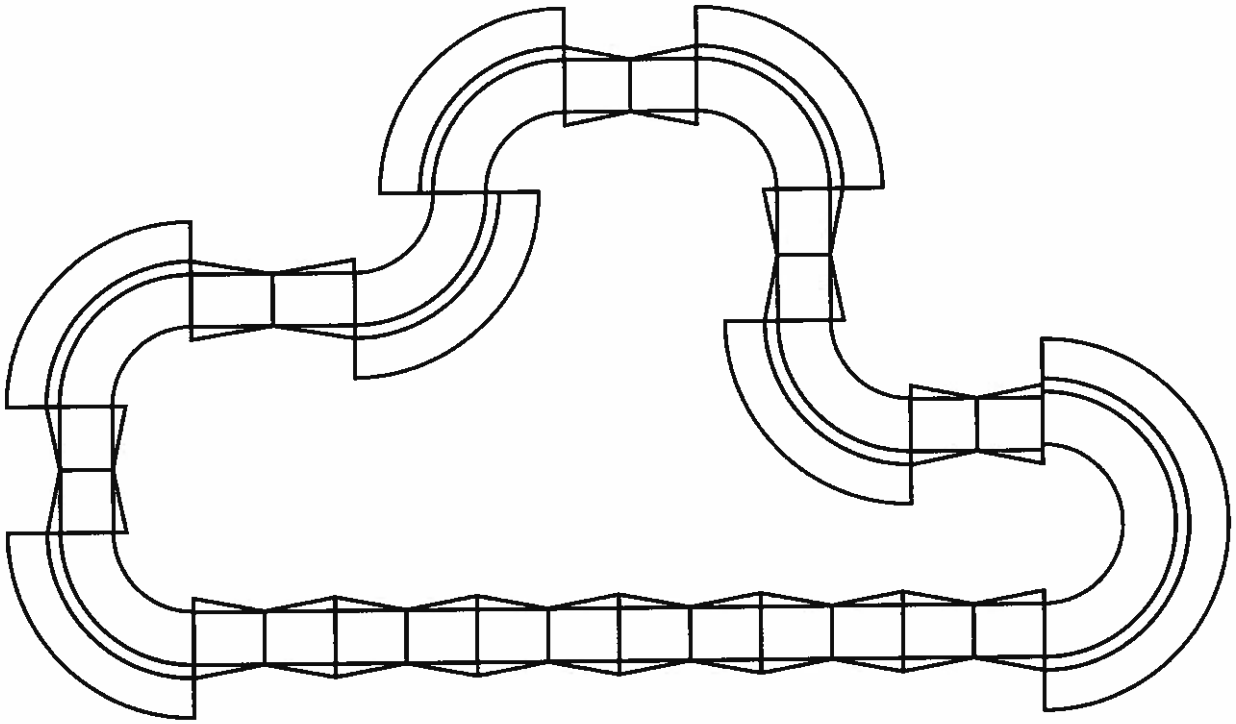


Note: These rollers and berms can be 12 feet (for a faster track) or any size you wish.

Hot tip: You can print these, cut them out and make a paper model!



Every time I sit down to design the "perfect" pump track, I end up with something like the Pumptopia design:



Mix up the features. In my opinion, a great track has a combination of

- Fast straightaway(s).
- Hyperspeed 180° left berm at the end of the straight. Most people turn faster to the left.
- Linked turns.
- Rollers that can be pumped, manualed or jumped.
- Perhaps some crossover lines.

Iterate, iterate then iterate some more. You are not gonna stumble into the perfect design on the first try (Unless you're some kind of pump track design genius). Make a sketch. Think about it. Make another. Consider the flow in all directions. Think about who's going to be riding the track. Make another sketch.

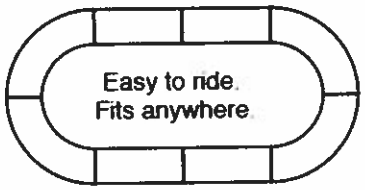
Here's a tip for a fast, flowy track. A 90-degree turn with a radius of 10 feet is about 14 feet long when measured from the entrance straight across to the exit. When your roller spacing is also 14 feet, the distances across your rollers and through your berms are roughly equal. This makes the timing on your straights and berms almost the same, and the track has a super easy, fast flow.

Plan thrice. Measure twice. Build once. You *do not* want to tweak the design while you dig.

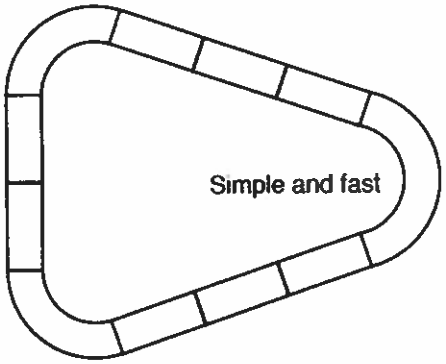
Sample layouts

The possibilities with pump track design are endless. Here are some basic, proven designs to get your ideas flowing.

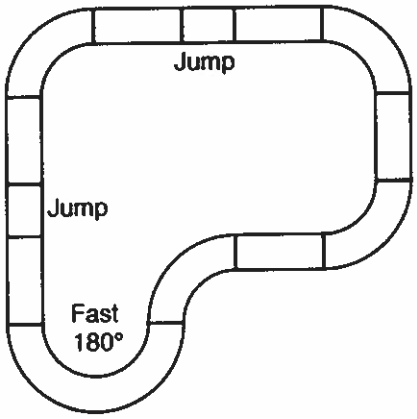
Tiny Little Track



Sweet Little Track

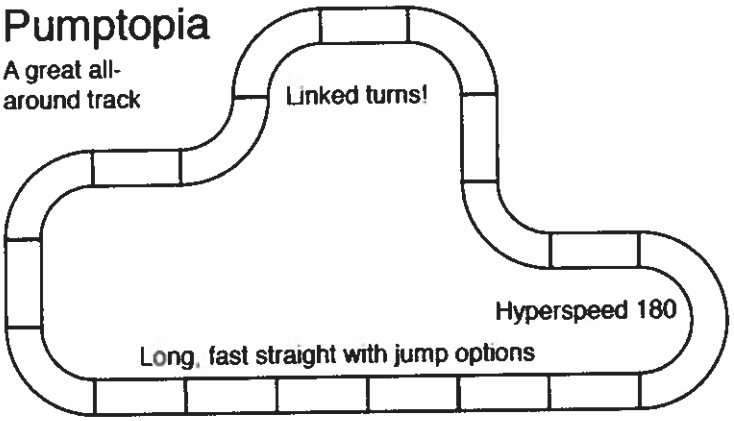


Pump 201

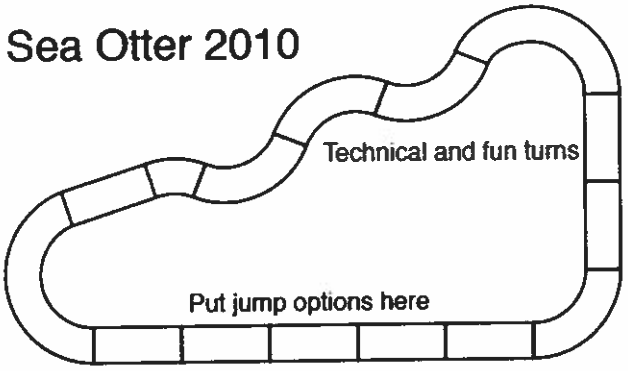


Pumptopia

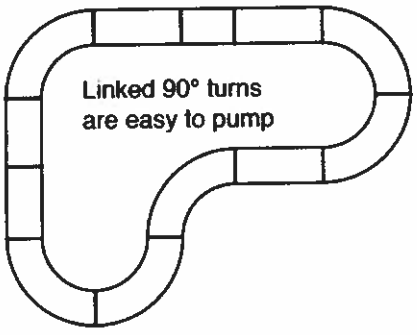
A great all-around track



Sea Otter 2010



Pump 101



For detailed, ready-to-build plans, check out www.leelikesbikes.com.

What kind of dirt?

If you have zero budget and you're digging up your yard, then the dirt you have is the Best Dirt Ever. Have at it!

If you have the opportunity to choose where you dig up your track, or you can afford to import dirt, you have a decision to make: What sort of dirt should you use?

Soil science is, well, a science and its own huge can of worms that we will leave tightly closed. Put as simply as possible:

Clay, silt, sand. Dirt is characterized by the sizes of its particles.

- Clay is the smallest particle. It shapes easily, packs together well and, when dry, creates a hard/fast surface. You want lots of clay.
- Sand is the biggest particle. It allows water to drain. When mixed with clay and water, sand can form a solid aggregate — aka a hard/fast riding surface. You want some of that action. But: If there's too much sand in your track, there's no cohesive strength, and your track falls apart.
- Silt is the medium sized particle. It doesn't pack well. We should use minimal silt.

It's all about the right mix of clay and sand.

The Sea Otter Classic 2010 pumptrack had almost the perfect mix of clay and sand. It was very shapeable and packable, yet it handled water pretty well:

UCI BMX track specifications call for 80% clay, 20% sand and 0% silt. This makes a very hard, very fast surface, but it's not rideable when wet.

We've had success with clay loam, which is about 40% clay, 40% sand and 20% silt. This makes a shapeable, fast surface that handles water well.

The sweet spot appears to lie between 80/20/0 and 40/40/20 clay/sand/silt. So let's say you want 40-80% clay with the remainder sand (≥20%) and minimal silt (≤20%).

The drier your climate, the more clay you want. High-clay dirt is strongest when dry. This is ideal for tracks that don't see much rain, and that don't get watered.

The wetter your climate, the more sand you want. Sandy dirt is strongest when wet. This is ideal for tracks that see rain, and that get watered on a regular basis. Valmont Bike Park in Boulder, CO uses a custom mix of about 30/60/10 clay/sand/silt. This makes the tracks supersweet soon after it rains and after the automated sprinklers do their magic. However, when the tracks are dry, the turns get sandy and loose.

Filter your dirt. Rocks, gravel, roots and other chunks complicate shaping and packing, and they make your track wear prematurely. You want pure, sweet clay/silt/sand. A little dark organic matter is fine.

Over time, the rocks make their way to the riding surface, and the track falls apart:

When you talk to your material supplier, start by asking about topsoil and clay loam. These materials make great tracks, but they can be expensive.

Baseball infield mix is often cited as a good material for tracks. If it has at least 40% clay and less than 20% silt, it should work fine (and be a cool red color).

"Clean fill" aka filtered fill aka screened fill can work, but dirt vendors have different definitions of fill dirt, and the notion of "clean" varies widely. Before you order fill dirt, find out specifically what it's made of. Better: Test it yourself (see below).

Don't cap it. You might be tempted to use cheap dirt as a base, then cap your track with nicer dirt. I advise against this.

- Unless your cap is very thick, you will eventually wear it down to the base layer.
- Pump track features are small, and they should touch grade level. So there's no space for a cap layer.
- The cap layer will eventually start sloughing off the base layer. Once this starts, your track will fall apart.
- The exception might be the bowels of a huge berm. You can fill that with whatever then build lots of dirt on top of it.

Don't treat it. You might be tempted to use bad dirt then "make it right" with SoilTac or a similar surface treatment. I advise against this.

- It messes with drainage. Water doesn't penetrate the treated surface, and it runs elsewhere, where it can cause damage. This happened when Valmont Bike Park was using SoilTac.
- Some errant pedal is gonna punch into surface and make a crack, then the surface will start to chip apart.
- Water has a way of seeping between the top hard layer and the below material. Once this happens, the top layer will flake and slough off. Especially troublesome in places that freeze.
- Rather than use crappy material then Band-Aid it with an expensive pain-in-the-ass treatment, use good, homogeneous material.

Lake Cunningham Bike Park in San Jose, CA has very sandy dirt capped with SoilTac. The big pump track is falling apart:

That said, if you are stuck with less-than-great dirt, and you have access to SoilTac, go for it. Stay on top of maintenance.

Testing your dirt

How much clay, sand and silt does your dirt have? You want to know this before you spend a few thousand dollars, and before there's a 120-yard pile of it at your house. Here's a cheap and fun way to find out:

- Fill a mason jar halfway with your dirt. Make sure all clumps are broken down.
- Fill the jar most of the way with water.
- Add a teaspoon of dishwashing soap.
- Shake the heck out of the dirt/water mixture. Really shake it.
- Set the jar somewhere quiet for 24 hours.
- The sand will settle at the bottom. Silt will settle on top of the sand. Clay will settle on top of the silt. That stuff that's floating around on top? That's likely organic matter.
- Measure the height of each layer then divide that by the total height of all the layers.
- Viola! You know what your dirt is made of.

If you're going to dig up your yard, test the endemic dirt before you start digging. If the material is way out of spec, you might need to reconsider your plan.

If you're going to import dirt, test the dirt *before* it gets delivered!

How much dirt do you need?

If you're digging up your yard, dig up as much as you need. If you have extra dirt, make your berms taller and steeper. Easy.

If you're ordering dirt by the truckload, you're gonna need some math. The following equations aren't *perfect*, but they're proven to work (it's crazy how often we put the last bucket of dirt where it needs to go, and there's no extra dirt). The math goes like:

((Volume of berms in cubic feet + Volume of straights in cubic feet) / 27 for cubic yards) x 1.3 for compaction = the volume of dirt you'll need.

Calculating the volume of a berm

Riding surface
((2 x radius x 3.14) x (degrees/360)) x width of riding surface x (height of berm x .5)

Top of berm
((2 x (radius + (width of top / 2)) x 3.14) x (degrees/360)) x width of riding surface x (height of berm)

Back of berm
((2 x (radius + (height / 2)) x 3.14) x (degrees/360)) x height of berm x (height of berm x .5)

Riding surface + top of berm + back of berm = entire berm

Calculating the volume of a straight

Riding surface
Length x width x average height

Edges
Length x average height x average height

Riding surface + edges = entire straight

These equations give you cubic feet. To convert them into cubic yards, divide by 27.

Once you have cubic yards, multiply by 1.3 to account for compaction.

Cubic yards are approximately the same as tons, so you can use them interchangeably.

Definitions:

Radius: The radius of your turn at the outside riding line. This will usually be 10-12 feet.

Degrees: How many degrees does your corner change direction? 90°? 180°?

Width: The width of your riding surface. If you're using a loader, it's the width of the bucket (about four feet).

Average height: What is the average height of this section? If your straight has all 1-foot rollers, its average height is 0.5 feet. If all rollers are 1.5 feet tall, the average height of the straight is 0.75 feet.

If your straight has a mix of small and tall features, you can calculate it as multiple short sections. For example, Section 1 might have an average height of .5 feet, and Section 2 might have an average height of 1.5 feet. You can add the two sections to make a total for your straight.

Download our handy spreadsheet. Simply enter some info for your track, and let the power of math do the work for you. When you reach this page, click the "dirtcalculator" link. www.leelikesbikes.com/dirtcalculator

Pump Track Nation dirt quantity calculator

Lee McCormack : www.leelikesbikes.com : Oct. 21, 2019

yellow highlighted cells are for your inputs

Cubic feet	1298
Cubic yards	48
Compaction	1.3
Total cubic yards	**62**

Berms

	Radius	Degrees	Width of riding surface	Width of top	Height of berm	Riding surface	Top of berm	Back of berm	Cubic feet
Berm 1	10	90	4	1	3	94.2	47.1	70.65	211.95
Berm 2	10	90	4	1	3	94.2	47.1	70.65	211.95
Berm 3	10	90	4	1	3	94.2	47.1	70.65	211.95
Berm 4	10	90	4	1	3	94.2	47.1	70.65	211.95
Berm 5	0	0	0	0	0	0	0	0	0
Berm 6	0	0	0	0	0	0	0	0	0
Berm 7	0	0	0	0	0	0	0	0	0
Berm 8	0	0	0	0	0	0	0	0	0
Berm 9	0	0	0	0	0	0	0	0	0
Berm 10	0	0	0	0	0	0	0	0	0

Straights

	Length	Width of riding surface	Average height	Riding surface	Edges	Cubic feet
Straight 1	50	4	0.5	100	12.5	112.5
Straight 2	50	4	0.5	100	12.5	112.5
Straight 3	50	4	0.5	100	12.5	112.5
Straight 4	50	4	0.5	100	12.5	112.5
Straight 5	0	0	0	0	0	0
Straight 6	0	0	0	0	0	0
Straight 7	0	0	0	0	0	0
Straight 8	0	0	0	0	0	0
Straight 9	0	0	0	0	0	0
Straight 10	0	0	0	0	0	0

Make a build sheet

Fortune favors the prepared. Before you start building your track, create a detailed build sheet that tells you everything you need to know about your track's layout.

Make sure your design is dialed in. The time to change is now, not when you're standing in the middle of 120 yards of dirt, just you and your tiny little shovel, and you realize your layout isn't gonna work.

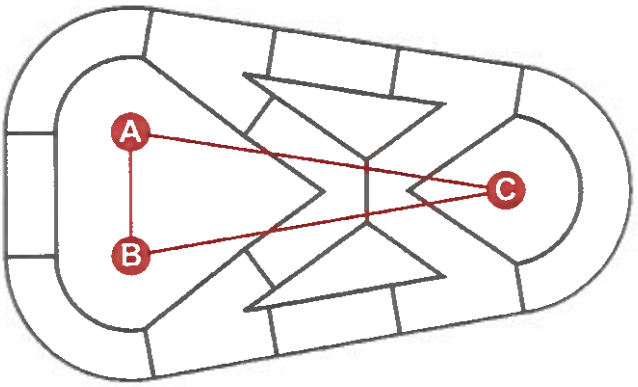
Draw an overhead view of the track. It should:

- Be to scale
- Show every corner
- Have markings for the top of each roller
- Show the shapes of the rollers/features

Name each corner A, B, C and so on. Set a plot point (A, B, C) at the centerpoint of each turn. Corners are the anchors of any pump track. If the corners are located and shaped correctly, your track can have great flow. If not, you'll end up with a track that rides poorly, or you'll have to rebuild.

If there are mandatory reference points outside the track (a tree and a bench, for example), name them X, Y, etc. You need to establish enough plot points that you can triangulate all of the track elements.

Measure the distance between each plot point. You can do this easily in a CAD or graphics program, or with a ruler on graph paper. Make sure every point is part of a full triangle, and that all parts of the track relate to each other. If your rollers aren't spaced evenly along the straights, measure their positions relative to the ends of the straights.



List the distances between your essential plot points. Make sure you've triangulated the centerpoint of each corner.

Here's a sample build sheet for a Pumptopia track with crossover options.

Reference points
Start with Point A, then set the below relationships. Be sure to drive stakes into the centerpoints of all turns (A, B, C, E, G, K).

AB 60 feet
BC 10 feet
AC 60.8 feet

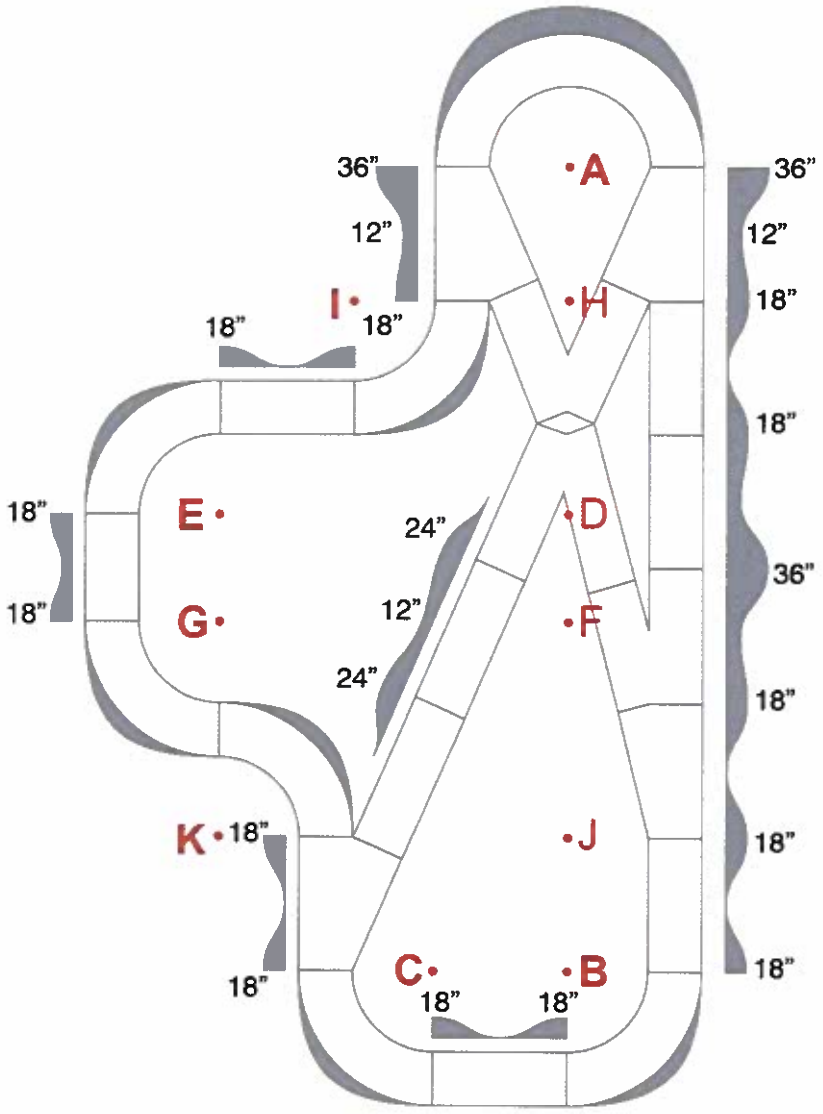
AD 26 feet
DE 26 feet
AE 36.8 feet

AF 34 feet
FG 26 feet
EG 8 feet
DG 27.5 feet

AH 10 feet
HI 16 feet
AI 18.9 feet

JK 16 feet
GK 16 feet
FK 30.5 feet

CK 19 feet



Draw your track on the ground

First, prepare your site. Grade it smooth, with a slight slope for drainage. Scrape away the top layer of loose, organic material so you build on a solid base. You don't have to scrape down the entire area; just clear the spots where the track will be. If you want to draw a "draft" on the ground before you prep the site, that's totally OK. Be sure to do your grading/scraping before you start building.

Painting the Sea Otter 2010 pro pump track:

Set your first plot point (generally A). If you have extra-trackular plot points (X, Y) make sure the track's first plot points are placed accurately. Triple check this measurement. Using your tape measure, start placing the rest of the plot points. Triple check the measurements.

Drive a stake into each plot point. On the stake Sharpie its letter (A) and the radius of the turn (10'). Create your own makeshift compasses by tying strings to all of the stakes. Make the strings' lengths the same as the turns' radii.

Using a can of marking paint and your compasses, draw out the corners on the ground. Mark the beginning and end of each turn with a line that runs perpendicular to the track. Make sure all your marks are accurate.

Once the turns are placed, draw the straights. Mark the tops of rollers/jumps with lines that cross the track.

By now your track should be drawn on the ground. Walk and run the track. Feel its flow. If there are any questions, measure and remeasure. The more accurate this is, the easier your build will be.

Plotting a track in Taos, NM.

Place your dirt

Take a look at your track layout. You don't want to start placing dirt then get your machine stuck in the track, or have to drive over part of the track that's already been placed. Plan the best order in which to place the dirt.

Using your skid steer loader, Dingo, wheelbarrow, buckets or bare hands, start placing the dirt.

Berms: Stack the dirt one foot behind the line you marked. Make the stack about 50% taller than the finished berm. The loader's blade should be oriented parallel to the track.

Rollers: Stack the dirt on the lines you marked. Make the stacks about 50% taller than the finished roller. If you're building a tabletop or roller-double, fill in the gap as well. The loader's bucket should be oriented perpendicular to the track.

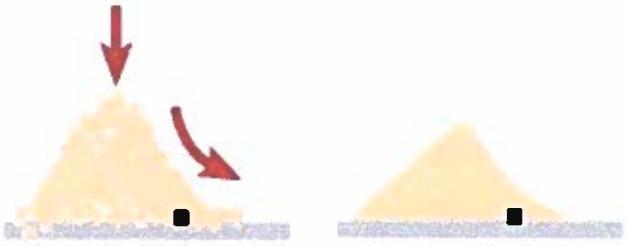
Sea Otter 2010 pro pump track. Dirt is placed and ready for shaping:

Shape your track

So far, you've planned at least thrice and measured at least twice, and your dirt piles are exactly where they need to be. Now comes the feel part.

Use your tool of choice. Flat shovel, steel rake, hoe, McLeod, whatever you prefer. Comfort, familiarity and smoothness trump all else. Some builders have one trusty shovel that they use for everything.

Work from the top down. It is pretty much impossible to make a beautiful shape by stacking dirt upward. Instead, slide dirt downward from the top of the pile to get the shape you want. Let gravity help you. This applies to rollers, jump faces and berms.



Make your rollers as smooth and round as possible. Strive for perfect sine waves. (Unless you're making the rollers pointy on purpose; see the jumps section.)

Form a constant radius from the top of your berm all the way to where the berm touches grade level on the inside of the track.

Make your berms as steep as you can. 180s should be banked at least 60°. 90s should be banked at least 45°.

Whittling a work of art from piles of clay loam. 2010 Sea Otter pro pump track:

Shaping in Taos, NM:

If you dig up your yard

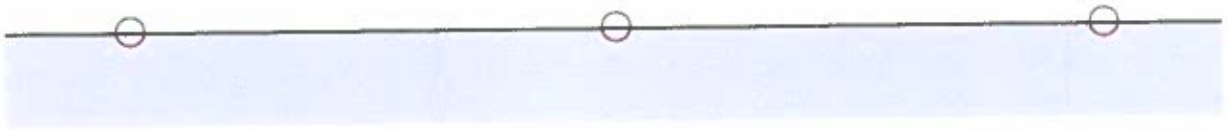
Berms

Stand on the inside of the turn and pile dirt to the outside. The top of the pile should be about one foot to the outside of the main riding line.

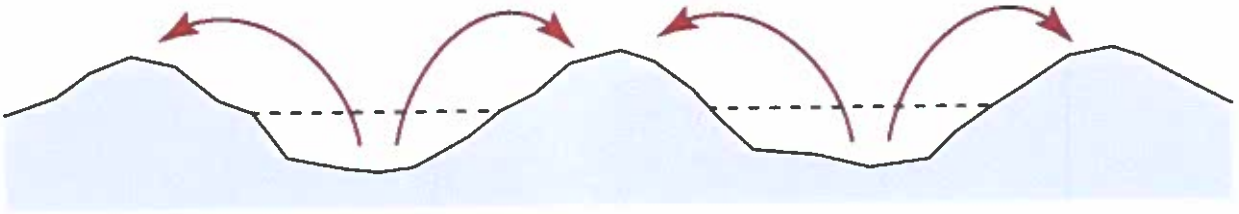
Once you have a pile that's 50% taller than your desired berm, start shaping it downward to create a constant radius from the top to the bottom.

Rollers

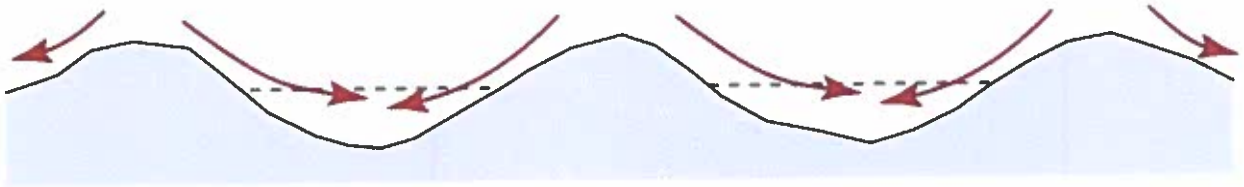
Mark where you want the peaks of your rollers to be.



Dig down into the bottoms of your future troughs. Pile dirt on top of the roller marks. Make the piles 50% higher than you want the rollers to be.



Start shaping from the top down. Slide the dirt off the piles to form a wave shape.



Viola! You have a sweet set of rollers.

About soil compaction

When you pile dirt on your track, there's lots of air between the particles, and the dirt is loose.

When you properly compact your dirt:

- It gets harder. This makes your track roll faster and prevents bumps and ruts.
- It has more shear strength. When you corner, your tires grip the surface rather than tear it up.
- It's less water permeable. Rain is more likely to sheer off the surface and less likely to make a soupy mess.
- It reduces swelling and shrinking. You get less cracking in clay surfaces.

When you don't pack your dirt properly, it rolls slow, the corners get loose and rain wrecks the track. Does that sound familiar? This is all too common because compacting soil is a lot of work, and not everyone is down for that.

When you compact your dirt, you mix it with water then hit it with pressure and/or impact. This gets the particles moving, and they settle closer together so there's less air and more mechanical grip.

Each dirt has its optimal moisture content. Too little water and the dirt doesn't pack. Too much water and the dirt doesn't pack either. Sandy dirt needs less water than clay-ey dirt. You get a feel for this after some water/pack cycles, but you can also:

Give it a squeeze. To easily determine whether your dirt is the right level of wet, pick up a handful of material. Squeeze it in your hand, then open your hand. Take a look then drop the clump onto the ground.

- The dirt is too dry if it's loose and won't hold its shape, or if it shatters when you drop it on the ground.
- The dirt is too wet when it leaves moisture on your fingers, or it stays in one piece when dropped.
- The dirt is just right when it holds its shape, is moldable and breaks into a couple pieces when dropped.

The more energy you put into compaction, the greater the density of the packed soil (which seems obvious) and the less water you need (which is not obvious). Walking on your track then slapping it with a shovel isn't gonna do the job. You need to put some oomph into it via muscles or gasoline.

Use the right tool. All packing should start with feet then go to hand tools: a shovel then a hand tamper. If you have the means, you can finish with power tools. But which kind?

Vibratory plate compactors (aka Wacker plates) are popular. They have a large, flat base that vibrates super fast. This surface vibration works best for granular dirt like gravel and sand. While a Wacker plate is a lot easier than muscles, and it's way better than no power tools, it's not ideal for the clay materials we prefer to use on tracks.

Wacker plate (made by Wacker Neuson)

Vertical rammers (aka jumping jacks) might be better for most tracks. They have a smaller pad and a more violent impact. This penetrates tiny, sticky clay particles, gets them moving and settles them closer together. With help from a partner, a jumping jack can be used on steep berms.

Jumping jack

Don't forget hand tampers. They are cheap and portable, and they work really well (some places on the web say they work just as well as jumping jacks (but of course take longer)). They require endurance and intestinal fortitude, not to mention core strength. I personally love using a hand tamper.

Hand tampers! The 6x6" delivers more pressure than the 10x10".

Wacker plates work awesome on straights, especially with granular dirt:

Pack your track

Once your track has a nice basic shape, it's time to pack it.

A skilled operator can place, shape *and* pack with a Bobcat or Dingo.

I suggest starting with "softer" tools then gradually escalating to "harder" tools.

Round 1: Feet. Start by stepping. Finish by stomping. If you're wearing proper shoes, you'll leave lots of Vans or Five.Ten logos.

Round 2: Hand tools. Flat shovels work pretty well. Hand tampers work better.

Round 3: Power tools. Note: It's hard to use a Wacker plate on steep berms. Hit those with a hand tamper or rammer.

Stand on your berms. To give each berm a flat top that's about one foot wide, stand on top and shuffle from side to side.

Pack the backs of your berms and the sides of your straights.

Water the track. Get some moisture into the ground. Let the surface dry so it's not tacky, then pack the heck out the track.

Pro tip from Lee's stepson Ian. Lean on the tool and push your feet backward into the bank:

Water/ride/repeat

Traditionally, at this point people ride sections of the track, realized they messed up then rebuild them. That's not what we're doing here.

Your design, placement, shaping and pack are spot on, so:

Wet the track down. Don't soak it; just make it damp. Let the surface dry a bit so it doesn't stick to tires.

Ride! Ride like crazy until the surface is fully dry.

Water the track again. Same as before. Not wet. Just damp.

Ride again. Repeat like this all day. Each cycle will make your track harder and faster.

Have fun and be proud!

Maintenance

This track started off sweet (but too big and complex). A lack of maintenance turned it into an open field with random piles of dirt. Such a shame.

The better your design, materials and build, the less maintenance your track needs — but all dirt tracks need maintenance. If you want your track to be as dialed as possible:

Ride your track. The more you ride your track (especially with a little water on it; see below), the better its condition. The better your track's condition, the better your condition, which makes you happier, and helps you work more productively, and makes you a better partner/parent/friend, and thus improves the lives around you. So, for the good of the universe, you should ride every day.

Look at your track. It's beautiful, isn't it? Now look closer. Is the surface loose? Are there cracks? Are there ruts? Have alligators moved into the perpetual puddle? Don't let problems fester. Fix 'em.

Water your track. When you mix water, sand and clay just right, you create a sort of pavement — a bit like concrete. This is what you want. Before each session, give the

track a little spray (or hit it with your automated sprinklers). Get the track slightly damp (but not so wet that water pools or the dirt sticks to your tires), then ride.

This water/ride cycle continually burns in the riding line, making it faster and faster. When you've deposited rubber into the surface, you get what's called blue groove. Super fast, super fun and super sweet.

If you live in a place with afternoon thunderstorms, all the better. Ride after the rain stops. At my first track in Boulder, this was so great. It would rain (sometimes hard), then the track would drain fast (smart drains for the win), then we'd pin it. Braaap!

Sweep your track. This is an as-needed kind of thing. When your track gets a layer of loose material on top (this generally happens in turns), it gets sketchy. Get a push broom and *lightly* move the loose material off the riding area. I say lightly because we want to wear the track as little as possible. As a matter of fact, you should use a soft toothbrush.

> Note: If your berms aren't steep enough to match riders' lean angles, the tires will scrape the surface and wear down the berms very quickly. When your berms' angles match or exceed the riders' lean angles, the tires press into the surface rather than scrape, and your berms last way longer.

If you continually sweep loose material off of your track, you'll eventually end up with no track. Ideally, when we remove material, we put it back. Here's the routine:

- Your berm is loose.
- Sweep the loose material down into the bottom/middle of the berm.
- Water the berm liberally.
- Sweep the loose material up onto the riding surface of the berm. The water will make it stick.
- Ride the berm to smash the loose material back into the surface.
- Lightly water it again. Ride it again.
- It should be better than new.

Fill the cracks. If your track has a lot of clay in it, the surface will likely crack when it dries. This isn't the end of the world. Do the same routine as described above. Wet the area, sweep loose material into the crack, ride, wet, repeat.

Repair the ruts. Heavy rain can wreak havoc on berms. Repair them like the big-ass cracks they are.

Don't tolerate puddles. When it rains, do your berms breed bluegill? Do your troughs teem with trout? Shame on you. Puddles are a sign of poor planning and execution. In order of escalation:

1. Move water away from the track. Raise the surface here. Dig a trench there. Be creative. If you've been living with a drainage problem, you know where the water collects, and you'll have an idea where to send it.

2. Dig a drain. If there's nowhere to send the water, dig a hole adjacent to the puddle. On a straight, the hole will be alongside the track. In a berm, the hole will be to the inside of the track. Make the hole(s) big enough to contain the typical puddle, plus a bit extra for biblical events. If you want to be fancy, fill the drain with gravel.

3. Be patient. If you can't fix your puddle situation, wait out the rains or perhaps plant some fish. People who obsess about riding make great fishermen.

Cut the grass. If you ride the track on a regular basis, the riding lines will stay hardpacked and vegetation free. The margins might grow grass or weeds (or wildflowers). That's not the end of the world because the green looks nice, and the roots stabilize the ground. Just keep the plants trimmed so they don't interfere with vision or snag handlebars. Yes, you'll be leaning that much.

Rebuild as needed. If your track has become worn down by weather, or it's developed major holes, it's time for a serious intervention. Bring everyone who rides the track over. Tell the track you love it and appreciate it, but that it has a serious problem, and it's time for a major change, and that you all will help.

If you simply stack new dirt on top of the old dirt, there will be a boundary, and the new dirt will flake/slough off the old surface. Do this:

- Bring in new material. Ideally it's the same as or better than the original material.
- Scrape the old surface. We need to roughen it up so the two layers of material can intermix and bind together. Depending on how hard the surface is, you can use a rake, McLeod or even a pick axe. Loosen the surface at least a few inches deep. This is a great workout.
- Water the loosened surface. Make it good and wet.

- Add new material. After you've added the first few inches, mix it into the below layer with a rake or McLeod. Water it. Add the rest of the material as if you're building from scratch.
- Shape, water and pack like when you first built the section.

So sum it up, the best ways to keep your track running in prime shape are:

1) Build it well in the first place.
2) Do routine maintenance. This doesn't take long. Heck, it's part of the joy of owning a track. Kind of like caring for a zen garden.

James Hall and I built this track in Oak Creek, CO in a weekend with volunteer help. The locals are super invested, and they have taken good care of the track.

Managing risk

Laws vary. Talk to a qualified attorney in your state.

There, I said that. Now here are some basic ideas to help you maintain a safe track.

Make sure people know and accept the risks of riding your track. I suggest having riders and their parents sign a liability waiver. For a sample, keep reading.

Design and build. Rollers should be round, predictable and not bucky. Berms shouldn't be too tight, and they should have adequate banking. Layouts should be simple and not overly technical. Be careful about multiple lines that converge; they can cause collisions. Make sure the track is surrounded by smooth, open areas; you don't need people shooting out of the track into your sliding glass window.

Maintenance. Check the track daily. Wildflowers should be low enough so you can see the entire track. Surfaces should be hard packed, smooth and clean, with good traction.

Take turns. Whoever's already on track has the right of way.

Culture. Your pump track is your own little piece of mountain bike nirvana. Be selective about who rides. Cultivate a positive, empowering and safe riding environment.

Riders. If a rider simply doesn't have the body/bike control to ride safely, find a kind way to tell the rider not to ride your track. Good manners suggest handing him a beer and encouraging him to enjoy watching. Heck, he can shoot video. If a rider is a freaking nut who's taking risks, don't be kind. Be emphatic. "We don't ride like that here. Either back off or leave." I'm saying "he" because it's usually a he.

Protective gear. All riders must wear helmets. Everyone should wear eye protection and gloves. Knee and elbow pads are a good idea.

Bikes. People don't need fancy dirt jump bikes, but they do need quality bikes that fit correctly and are in good working order. Seats should be low. Stems should be short.

Supervision. Kids should definitely be watched and guided. Some adults too.

Signage. If you're building a public track, have your legal team write the sign and provide guidance about fencing and access.

I hate to talk like this, but imagine the worst case scenario. Did you do everything in your power to ensure safety?

Pump track liability waiver

Address:

_____

_____

I, THE NAMED PARTICIPANT, for myself and on behalf of my/our heirs, assigns, personal representatives and next of kin, hereby acknowledge that I voluntarily have applied to participate and use the Bicycle Track. I understand that the act of bicycling necessarily involves known and unknown risks of injury to me and other people, which includes but is not limited to death, permanent or temporary paralysis, disability, illness or disease, physical or mental damage, or other injury, as well as damage to my equipment and personal property. Some of these risks include the risks inherent in bicycling such as falling and coming into contact with berms, rollers and other object, latent or apparent defects or conditions in equipment or property, and passive or active negligent acts of myself, _____ (Below referred to as TRACK OWNER), other riders, Race Line Publishing and Lee Likes Bikes LLC. I understand that the above list of risks is not complete or exhaustive and that those and other risks known or unknown, anticipated or unanticipated may also result in injury, death, illness, disease to myself or my property or other third parties. I voluntarily agree and promise to accept and assume responsibilities, and injuries, death, illness, disease or damage to myself or my property arising from my participation in this activity.

I further understand that TRACK OWNER assumes no liability for loss, damage, or any kind of injury sustained by myself or my property while using the Bicycle Track. I therefore assume all risks associated with using the Bicycle Track, even if they arise from the negligence of TRACK OWNER, other riders, Race Line Publishing and Lee Likes Bikes LLC. My participation in this activity is voluntary and no one is forcing me to participate in spite of the risks. I understand the effect of this waiver and acceptance of risk on my legal rights.

By signing this release of liability and using the Bicycle Track, I hereby fully and forever release and discharge indemnify and hold harmless TRACK OWNER and all associates from any and all liabilities, claims, demands, damages, rights of action, suits or causes of action present of future, whether they same be known or unknown, anticipated or unanticipated, resulting from or arising out of my use or intended use of said Bicycle Track premises, facilities or equipment. I fully and forever release and discharge

TRACK OWNER and associates from any and all negligent acts and omissions in the same, and intend to be legally bound by this release.

Name of participant using facility:

_____

Date of birth: ____/____/_____

Signature of participant using facility:

_____

Today's Date ____/____/_____

Phone (_____)_____-_____

Driver's License
#_____

FOR PARTICIPANTS UNDER 18 YEARS OF AGE

This is to certify that I, as a parent or guardian with legal responsibility for the above named participant, do consent and ratify his/her release of the TRACK OWNER, and other riders, I release and agree to indemnify the TRACK OWNER, and all associates from any and all liabilities incident to my minor child's involvement or participation in the Bike Track as provided above, even if arising from the negligence of the TRACK OWNER, and its associates, to the fullest extent permitted by law. I have carefully read this release of liability and understand and fully agree with its contents.

* If the participant is under 18, this release must be signed in person by a parent/legal guardian.

I hereby certify that I am the parent or legal guardian of the participant named above, give my consent to the foregoing, and agree to hold the Bicycle Track harmless from any liability

_____

Parent or Legal Guardian

Parent/Guardian's Driver's License #_____

Let's do this!

I hope you found this (e)book helpful.

If you're interested in pre-made track designs, go to the Shop at www.leelikesbikes.com.

Custom designs and building services are available. Email lee@leelikesbikes.com.

Plan thrice, measure twice and build once!

Lee
lee@leelikesbikes.com

Railing Superior Bike Park in ColoRADo.

Made in the USA
Monee, IL
10 March 2024